

McKAY (R.J.) ~~Dr B. Jay Jeffries~~

WITH THE AUTHOR'S COMPLIMENTS

*Some Practical Remarks upon the Anomalies  
of Refraction and Accommodation of  
the Eye and their Complications.*

A PAPER READ BEFORE THE

DELAWARE STATE MEDICAL SOCIETY,

June 8th, 1880.

*for* BY READ JENNINGS McKAY, M. D.,  
OF WILMINGTON, DEL.,

MEMBER OF THE AMERICAN OPHTHALMOLOGICAL SOCIETY, THE INTERNA-  
TIONAL OPHTHALMOLOGICAL CONGRESS, AMERICAN OTOLOGICAL  
SOCIETY, AMERICAN MEDICAL ASSOCIATION, AND THE  
DELAWARE STATE MEDICAL SOCIETY.

---

1880:  
SCOTT & TOWNSEND,  
Milford - Del.







## *Some Practical Remarks upon the Anomalies of Refraction and Accommodation of the Eye and their Complications.*

For several years past I have felt desirous of attempting to elucidate somewhat the subject of Refraction and Accommodation of the eye, because it is so much enveloped in an obscurity of technicality, that it embarrasses and repels most persons who attempt to read and comprehend it from any of our numerous eye text books.

It will be my endeavor to make plain and intelligible this somewhat complex and abstruse subject, so that all who give me their attention may clearly comprehend its great practical importance and its wonderful and beautiful simplicity. In looking over my case-books recently and observing the frequency of my recorded cases of anomalous refraction and accommodation of the eye, I determined to present for your consideration to-day, *some practical remarks upon the anomalies of refraction and accommodation of the eye and their complications.* To a clinical study of 413 successive and carefully recorded cases of these deformities of the eye, I wish to invite your attention, and to point out their various complications with one another, and that they also in a greater or less degree cause or complicate numerous internal and external eye diseases. My object and apology for doing so are their very great frequency, and the increasing importance and usefulness an intelligent knowledge of the subject affords to the general practitioner of medicine. It is but little understood by the profession generally, because it cannot be readily comprehended by the simple reading and studying of text books, but it must be acquired clinically from private instructors, and by study and observation in some hospital or dispensary where eye diseases are treated. This remark applies to the medical student of to-day, as well as to practitioners of years of experience, because most of the professors of ophthalmology in our medical colleges, with a few honorable exceptions, for various reasons, do not attempt to present these subjects to students in a simple and comprehensible manner, and they should, therefore, be held responsible for much unnecessary suffering.



To refreshen our memories, I will very rapidly run over the anatomy of the eye as shown by this chart and have it serve me as a ready reference as I proceed with my subject. Just here permit me to explain the terms refraction and accommodation of the eye, for they will often be mentioned during the following remarks: "By refraction is understood, the passive power which every eye possesses when in a state of rest, i. e. adjusted for its far point (of vision) of bringing certain rays to a focus upon the retina without any active effort or participation of the muscular apparatus of accommodation." This power of refraction is due to the form of the eye and to its different refracting media. Referring to the chart we see those media to be from before backwards, the cornea, aqueous humor, crystalline lens and vitreous humor. They act together simply as a lens to form images of external objects upon the retina.

"By the term accommodation is meant the power which every normal eye possesses of adjusting itself almost imperceptibly and unconsciously for different distances." "Hence, it appears that refraction is dependent upon the anatomical condition of the component parts of the eye; accommodation, on the contrary, depends upon the physiological action of muscles." These muscles are the ciliary, and are situated entirely within the eye-ball, beneath the front edges of the sclerotic, as the chart shows. They are often called the muscles of accommodation, which name explains their physiological function. They act upon the crystalline lens by pressure; and increase its central antero-posterior diameter, by making its posterior surface more convex, when the eye is being adjusted for nearer distances, than it is when in a state of rest, (that distance for the normal eye is twenty feet and all distances beyond.)

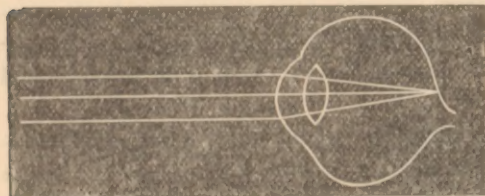
After this introduction I will proceed with our subject proper, viz.: some practical remarks upon the anomalies of refraction and accommodation of the eye and their complications. In order to simplify it, I will state there are four kinds of refraction of the eye, and that it is the length of the eye-ball in its antero-posterior diameter which enables us to thus classify them.

The first, is that in which the eye-ball is the proper length for optical purposes at all distances, and it is known as the emmetropic or normal eye. The second, is that in which the eye-ball is too long for *distant* optical purposes, and it is known as the myopic, or more familiarly the short-sighted or near-sighted eye. The third, is that in which the eye-ball is too short for *near* optical purposes, and it is known as the hypermetropic, or more famil-



ially, the far-sighted or long-sighted eye. The fourth, is that in which the eye-ball is of an irregular length, and consequently its refraction is irregular; that is, one or more of its meridional diameters is longer or shorter than all the others, and it is known as the astigmatic or irregularly refractive eye.

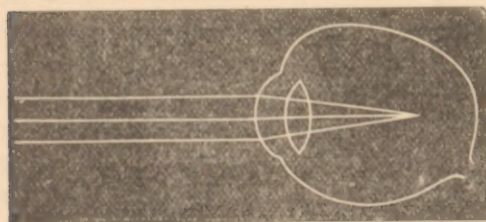
Permit me just here to state that the term presbyopia, which is the receding of the near point of vision as we grow older, is not as has been supposed, "an anomaly of refraction, but a diminution in the range of accommodation." (By the range of accommodation is meant the distance between the remote and near points of vision of an eye. Of course it differs in eyes of different refractive power). All kinds of eyes, sooner or later, after the age of maturity is past, become more or less affected by presbyopia, as shown by the general resort to glasses, or a change of glasses for reading, writing, sewing and all near uses.



[THE EMMETROPIC OR NORMAL EYE.]

The first kind, the emmetropic or normal eye is congenital. It is not frequently seen even in special practice, which shows it is not nearly as common as the abnormally refractive one, and it does not interest us, except that it becomes presbyopic, sooner or later after maturity, and then convex glasses are needed for all near uses of the eye, and it occasionally becomes myopic or near-sighted in persons who use it constantly in such occupations as engraving, drawing, or long continued literary work.

The first kind, the emmetropic or normal eye is congenital. It is not frequently seen even in special practice, which shows it is not nearly as common as the abnormally refractive one, and it does not interest us, except that it becomes presbyopic, sooner or later after maturity, and then convex glasses are needed for all near uses of the eye, and it occasionally becomes myopic or near-sighted in persons who use it constantly in such occupations as engraving, drawing, or long continued literary work.



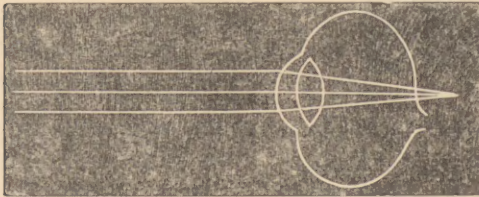
[THE MYOPIC EYE.]

The second kind, the myopic or near-sighted eye may be either hereditary, congenital or acquired, and its frequency is constantly increasing in the more civilized and cultivated countries.

It is very commonly affected by serious internal diseases of the choroid, optic nerve, and retina, (most frequently in the order mentioned) as the eye-ball slowly but steadily elongates, when the near-sightedness is progressing. The elongation occurs at its posterior

portion, to the outer side of the optic nerve entrance, and is accompanied by a thinning and bulging backwards of the sclerotic coat, which over-stretches, and more or less injures the choroid coat at its attachment around the optic nerve, and it generally begins at its outer or temporal portion. This undue distention usually causes, if not checked in its progress, more or less irremediable disease and atrophy of the choroid, as well as greatly endangers the macular region, the most sensitive and important part of the retina. These lesions are attended by more or less loss of sight, and in extreme cases detachment of the retina, with total loss of the eye. Unfortunately the beginnings of these internal disorders are not frequently attended by symptoms sufficiently uncomfortable or painful to make their presence known or felt.

Usually only a slight increase of the near-sightedness is noticed, and it is not considered worthy of mention, because myopes, (near-sighted persons) are so accustomed to such symptoms. Myopia (near-sightedness) is the most frequent cause of divergent strabismus, (outward squinting) and it often prolongs or aggravates blepharitis (inflammation of the edges of the eye-lids) and conjunctivitis of the lids.



[THE HYPERMETROPIC EYE.]

The third kind, the hypermetropic or far-sighted eye, is hereditary and congenital, but never acquired. It is the one most frequently seen by the oculist, because persons with short

or shallow eyes, by the unavoidable and necessary constant use of their ciliary, or accommodative muscles, in their unconscious and vain attempts to elongate their eyes, to maintain their increased focal power, in order to preserve distinct vision at all distances, sooner or later strain those muscles, and they begin to suffer with symptoms of asthenopia, that is weak and painful sight. A variety of distressing symptoms are sooner or later often experienced by them, such as blurring of eye-sight after a few moments near use of their eyes, photophobia, (dread of light) fatigue or pain within or around the eyes, and if they persist in using them, frontal or occipital neuralgia, dizziness, nausea, and occasionally vomiting complete their catalogue of sufferings, sending them to bed and to rest. Several hours or days rest, more or less recuperates their bodies and their eyes.



They begin to use the latter soon again, and again to go through a period of more or less suffering, depending upon how long they continue to over-use them. Hypermetropic (far-sighted) persons are not subject to diseases of the fundus of the eye, but to weakness and paralysis of the ciliary and recti muscles.

Hypermetropia, (farsightedness) causes such external eye-troubles as convergent strabismus, (internal squinting,) certain kinds of double vision, and pterygium, and by the unnatural friction and pressure of the eye-lids upon the eye-balls to improve vision, it often causes tumors of the eye-lids, styes, inflammation of the margins of the eye-lids, and prolongs granular conjunctivitis of the lids.

The fourth kind, the astigmatic or irregularly refractive eye, is often hereditary and almost exclusively congenital. Occasionally, the astigmatism, (irregular refraction) may be caused by an irregularity in the healing of wounds of the cornea, or displacement of the pupil, after accidents or operations. Astigmatism is most frequently found in eyes which are abnormally too short or too long; that is, it usually complicates either myopia, (near-sightedness) or hypermetropia, (far-sightedness), and when it does, it is known as compound myopic or compound hypermetropic astigmatism. It does it two ways, that is, the astigmatism either increases, or diminishes the preponderating abnormal refraction. Astigmatism may also occur in eyes, which are of the normal length in all but one of its meridians, and it is called simple myopic, or simple hypermetropic astigmatism, depending upon the shortening or lengthening of the abnormal meridian. Very rarely, there is a mixture of both far-sighted and near-sighted astigmatism in the same eye, and it is called mixed astigmatism. The abnormally refractive meridians in these cases cross each other at right angles, and from early childhood until they are discovered, and properly corrected by glasses, are a source of annoyance, most difficult to describe.

Astigmatic eyes, like hypermetropic ones, are frequently prone to asthenopia, (weak and painful sight) as manifested by its most varied and aggravated symptoms, which is due to the irregular and strained action of the accommodative muscles. These asthenopic symptoms, in both hypermetropic and astigmatic persons, most frequently manifest themselves during periods of debility, after prostrating illnesses of various kinds, and occasionally after long

continued use, amounting to abuse of the eyes. Persons with these deformities of their eyes, then for the first time discover they have some inherent ocular weakness, and often apprehend total blindness will soon be visited upon them, and in a great state of anxiety they seek medical advice for relief of pain, with but faint hopes that their deteriorated vision can be restored.

To give you a better idea of astigmatism than words can convey, I will pass around some cylindric test glasses and ask you to look at a test dial through them, and at the same time make some explanatory remarks upon test glasses.

In confirmation of the foregoing remarks, I wish to present to your attention, some statistical considerations based upon the notes of my 413 successive and carefully recorded cases of anomalous refraction and accommodation of the eye, with their various complications.

261 were female, and 152 were male patients. Their ages varied from  $4\frac{1}{2}$  to 80 years. The youngest was a child afflicted with convergent strabismus, dependent upon hypermetropia, (far-sightedness.) They were from all the different stations of city and country life, from the very poor to the rich and affluent. Consequently their occupations were very various. Those who suffered with asthenopia were mostly persons who had been debilitated and used their eyes too soon thereafter, before convalescence was fully established, or had used them too continuously at near work of some kind.

188 were cases of hypermetropia.

27 " " " " with an undetermined astigmatism.

44 were cases of compound hypermetropic astigmatism.

86 " " " myopia.

28 " " " compound myopic astigmatism.

5 " " " simple " "

1 was a case of mixed astigmatism.

30 were cases of presbyopia.

2 " " " spasm of accommodation.

2 " " " paralysis of "

Among the 413 cases, were 9 cases which had different kinds of refraction in their two eyes. In 5 of the 9 cases, one eye was far-sighted and had good vision, and the other was near-sighted, with poor vision and internal lesions



of their fundi. The other 4 cases were affected by myopia or hypermetropia and astigmatism.

87 of the 188 cases of hypermetropia, manifested asthenopia.

27 " " 86 " " myopia " "

56 " " 105 " " astigmatism " "

4 " " 4 " " accommodative disease manifested asthenopia.

There were four " " asthenopia dependent upon weakness of the recti muscles. Among the 413 cases, there were therefore 178 of them afflicted with asthenopia, considerably more than one-third of the entire number.

31 of the 188 cases of hypermetropia were complicated with conjunctivitis.

6 " " " " " " " " blepharitis.

7 " " " " " " " " both blepharitis and conjunctivitis.

5 of the 188 cases " " " " " styes.

In 19 " " " " " " it had caused convergent strabismus.

" 9 " " " " " " pterygium.

" 7 " " " " " " diplopia. (double vision.)

In 3 of " " " " " " insufficiency of the internal recti muscles.

40 of the 188 cases " " were presbyopic.

10 of the 86 cases of myopia were complicated with conjunctivitis.

3 " " " " " " " " blepharitis.

6 " " " " " " " " both conjunctivitis and blepharitis.

7 of the 86 cases " " " presbyopic.

31 " " " " " " " complicated with posterior staphyloma, causing more or less choroidal disease, and other serious disorders of the fundus.

11 of the 105 cases of astigmatism were complicated by conjunctivitis.

1 " " " " " " " was " " blepharitis.

13 " " " " " " " were " " both conjunctivitis and blepharitis.

2 of the 105 cases " " " " " with the most distressing and perplexing symptoms of double vision.

Two of the 105 cases of astigmatism were affected with paralysis of accommodation, without the dilatation of the pupil, which usually so promptly indicates the paralysis of the ciliary muscle.

In seven of the forty-four cases of compound hypermetropic astigmatism, the astigmatism was an increase or adding to, the general hypermetropic refraction.

In thirty-seven of the forty-four cases, the astigmatism was a diminution or subtracting from the general hypermetropic refraction. These latter manifested the most pronounced and excruciating symptoms of asthenopia, which usually rendered them unfit for any comfortable or continued use of their eyes. They all required from three to six days' use of a gr. iv. solution of atropia to thoroughly paralyze their painful and irritable ciliary muscles, before the proper glasses could be selected, which corrected their irregular refraction. Their vision for all distances was always improved, and oftentimes to a wonderful and surprising degree.

It is necessary to use atropia or duboisia in all cases of abnormal refraction, which have decided asthenopic symptoms, before glasses can be properly fitted, because the spasmodic action of their accommodative muscles, continuously masks the actual refraction of their eyes, and persistently prevents its determination and correction.

There are quite a number of children who begin to manifest asthenopia at school, and oftentimes months or years pass without their teachers or parents discovering it. Frequently also some children who seem dull and slow in acquiring their lessons, (whereas in all their other relations of daily life they appear as bright and as intelligent as their associates,) have some refractive trouble of their eyes, and if it is not corrected, it causes them great inconvenience and often suffering, and it may mar their prospects in life beyond amelioration.

Lastly, I will mention a medico-legal point, which has occupied my thoughts for some time past, viz.: the disagreement of equally credible witnesses in giving testimony of occurrences dependent upon eye-sight. Their discrepancies are oftentimes largely dependent upon their different degrees of visual power. I am fully convinced, and that visual power is more or less affected by the abnormal refraction of some of their eyes.





